

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

GARY KOOPMANN, TIMOTHY KIDD and
VICTOR PIRNIK, Individually and on Behalf of
All Others Similarly Situated,

Plaintiffs,

v.

FIAT CHRYSLER AUTOMOBILES N.V.,
FCA US, LLC, SERGIO MARCHIONNE,
RICHARD K. PALMER, SCOTT
KUNSELMAN, MICHAEL DAHL, STEVE
MAZURE and ROBERT E. LEE

Defendants.

Civ. Action No: 15-cv-07199-JMF

CLASS ACTION

EXPERT REPORT OF CHRISTOPHER M. ATKINSON, SC.D

August 15, 2018

TABLE OF CONTENTS

I.	Background and Qualifications.....	1
II.	Scope of Engagement	2
III.	Bases for Opinions.....	2
IV.	Summary of Opinions	3
V.	Overview of FCA’s Operations	3
VI.	Background.....	5
	A. Diesel Engines and NOx Emissions (and the Dangers Thereof).....	5
	B. Controlling NOx in Diesel Vehicles	7
	C. Engine Control.....	8
	D. Engine Calibration	10
	E. Aftertreatment Control.....	11
	F. On-Board Diagnostics (OBD).....	12
	G. Emissions Control Systems	13
	H. Exhaust Gas Recirculation (EGR)	14
	I. Selective Catalytic Reduction	17
	J. On-Board Diagnostics (OBD).....	19
VII.	Emissions Regulations	20
	K. Emissions Testing	25
	L. Certificates of Conformity	29
VIII.	The Subject Vehicles	31
IX.	The Volkswagen Diesel Scandal	33
X.	FCA’s Violations of Emissions Regulations	34

A.	“AECD #5” – T_Engine (or Modeled Engine Temperature)	34
1.	Discussion	36
2.	T_Engine Is An AECD That FCA Failed To Disclose and Is A Cycle Detecting Defeat Device	57
B.	“AECD #1” and “AECD #2” – EGR Shut-off / Reduction At Highway Speeds .	61
C.	“AECD #3” – EGR #12 (Valvetrain Cleaning Routine)	70
1.	Discussion	72
2.	The Valvetrain Cleaning Routine (EGR #12 / AECD #3) Is An AECD That FCA Failed To Disclose and Is A Cycle Beating Defeat Device	79
D.	“AECD #7” – Online Dosing (Or “Alternative Precontrol Dosing”)	81
1.	Discussion	84
2.	Online Dosing Is An AECD That FCA Failed To Disclose and Is A Cycle Detecting Defeat Device	100
E.	“AECD #6” – SCR Catalyst Warm-Up Disablement	103
F.	“AECD #4” – Diesel Exhaust Fluid (DEF) Dosing Disablement During SCR Adaptation)	107
G.	“AECD #8” – Use of Load Governor to Delay Ammonia Refill of SCR Catalyst	119
H.	The Eight Undisclosed AECDs, Alone or in Combination, Reduce the Effectiveness of the Emission Control System	123
I.	In Late 2015, EPA and Bosch Informed FCA That Its Vehicles Violated Emissions Regulations And Contained Defeat Devices	126
1.	EPA Investigation	126
2.	Bosch Investigation	144
J.	West Virginia University Testing	146
XI.	FCA’s Practices and Procedures For Ensuring Compliance With Emissions Regulations Were Inadequate and Ineffective	147

A.	FCA Had A Culture of Non-Transparency With Emissions Regulators	147
B.	FCA Expended Significant Effort on Control and Calibration Specifically For Reducing Emission Controls For “Off-Cycle” or Real-World (RW) Operating Conditions	154
C.	FCA Demonstrated Poor Practices in Describing Engine Control, Calibration and Diagnostics Features to EPA	156
XII.	FCA’s Statements Concerning Compliance With Emissions Regulations Were False and Misleading.....	160

18. The combination of running lean, running unthrottled, and the high compression ratio of these engines leads in general to higher potential engine efficiency, compared to comparable spark-ignited engines, and superior low speed engine performance, but with the potential for higher exhaust emissions of particular emissions species, most notably NO_x and PM.

B. Controlling NO_x in Diesel Vehicles

19. Controlling the production of NO_x from a diesel engine is typically achieved through a combination of (a) in-cylinder methods (by minimizing the production of NO_x in the combustion chamber(s) or cylinder(s)), at the time of combustion and (b) aftertreatment, or the chemical remediation of the NO_x produced in-cylinder, in the exhaust system downstream of the engine (and hence after the combustion process).

20. Typical in-cylinder methods of NO_x reduction include careful control and regulation of the fuel injection process (including through control and calibration of the injection timing, the injection pressure, the intake boost pressure, the intake temperature, and the proportion of exhaust gases recirculated to the intake manifold, in the process termed “exhaust gas recirculation” or EGR).

21. Aftertreatment (or remediation) of the exhaust emissions formed in the engine cylinder(s) can be achieved through the use of a diesel oxidation catalyst (DOC) (that reduces hydrocarbon emissions from the engine through the catalytic oxidation of the gaseous hydrocarbons in the exhaust gas in the presence of the excess oxygen in the exhaust at sufficiently high temperatures), the use of a diesel particulate filter (DPF) (that may itself be catalyzed to allow for the oxidation of the particulate matter emitted in the exhaust in the presence of the oxygen in the exhaust (at high enough temperatures)), and normally thereafter

the remediation of the NO_x in the exhaust (through the use of a selective catalytic reduction (SCR) device, in this case).

22. In selective catalytic reduction (or “SCR”), (in the version relevant to this matter) an aqueous urea solution (sometimes called diesel emissions fluid, or diesel exhaust fluid (DEF)) is injected into the exhaust gas stream upstream of the SCR device, and at sufficiently high temperatures the urea dissociates to produce ammonia, which then reacts with the NO_x present in the exhaust gases over the catalyst resident in the SCR device. Through the chemical process of reduction in the presence of ammonia, the NO_x is reduced to elemental nitrogen, and water vapor (with small quantities of carbon dioxide co-produced).

23. SCR operates most efficiently at somewhat elevated temperatures (in the range of hundreds of degrees Celsius), typical of the exhaust temperatures seen during normal engine operation (as opposed to cold start temperatures which are normally below the SCR catalyst “light-off” temperature or normal temperature ‘operating window’).

24. Good SCR operation and control requires the injection of a requisite (metered) quantity of urea – too little urea injection into the flowing exhaust gas and some NO_x will pass through the SCR device unreacted, while too much or excess urea injection can result in ammonia “slip” through the SCR catalyst, resulting in a concomitant unpleasant odor of the exhaust gases emanating from the tailpipe and potential deleterious human health effects.

C. Engine Control

25. Modern automotive engines, including diesel engines, employ electronic engine control and the use of one or more engine control unit (ECU) (or electronic control unit (ECU), or electronic control module (ECM)) to affect that control. Close control of the variables and/or parameters of engine operation is critical to ensure adequate engine performance and fuel

efficiency (or fuel economy) while meeting regulated vehicle exhaust emissions levels. Modern engines are equipped with a large number of sensors and actuators, that measure and control engine operation, respectively. In general, the engine or aftertreatment sensors sense or measure some physical, thermodynamic or chemical aspect of, output of or input to the engine – for example, these might include air mass flowrate (as a physical measurement), exhaust gas temperature (as a thermodynamic measurement), and NO_x concentration in the exhaust (as a chemical measurement). The engine actuators might control or regulate air flow, EGR flow or fuel flow into the engine, for example. Interceding between the measurement (such as sensors) and control elements (such as actuators) on the engine (or aftertreatment system), might be the ECU.

26. Modern ECUs incorporate engine control software (or “SW”), consisting of a number of algorithms used to control various aspects of the engine operation, including the high-pressure diesel fuel injection system, the EGR system, and other engine sub-systems, including for example the control of a turbocharger, or the use of an intake throttle. This SW relies on a pre-determined set of control algorithms for each of the controllable parameters on an engine and aftertreatment system (with the number of algorithms usually numbering in the hundreds or thousands) as well as a large number of calibration parameters (usually numbering in the thousands or tens of thousands). These control algorithms might be the SW-based implementations of a range of control ‘strategies’ that are called upon to control the engine operation in real-time. So, for illustrative purposes, a set of sensors on the engine might measure the engine’s response to a particular set of control commands sent to an array of actuators; while a set of engine control strategies implemented in a range of control algorithms might vary the actuator commands in response to changes in the engine operation as measured by the sensors.

45. As stated previously, one effective method of reducing NO_x within the engine cylinder(s) or combustion chamber(s) is through the use of exhaust gas recirculation. EGR is a mechanism for reducing NO_x formation in the engine cylinder(s) during combustion.

46. NO_x is believed to be formed in-cylinder in the flame zone surrounding each stream or jet of fuel injected into the cylinder, with the NO_x formation occurring, once combustion of the fuel starts to occur. The amount of NO_x formed in the cylinder during combustion is a strong function of the local oxygen concentration, the local nitrogen concentration, the local temperature and the time period over which the local gas temperature is elevated (the NO_x formation rate is usually described by the Zeldovich chemical formation mechanism, which shows an exponential dependence of NO_x formation on the gas temperature). The total NO_x formation during any one combustion cycle in a cylinder depends on the total integrated local NO_x formation, integrated across all locations in that cylinder, and integrated across time during the full combustion event – and in general, the higher the in-cylinder temperature, the higher the NO_x emissions – all else being equal. Similarly, the higher the oxygen concentration in the cylinder during the combustion process, the higher the amount of NO_x formed, all else being equal.

47. EGR is a useful mechanism for reducing the oxygen concentration during the combustion process in the cylinder by replacing some of the intake air (which is mainly nitrogen and oxygen) with recirculated (and normally cooled) exhaust gases (the cylinder or intake “charge” is the total amount of gas inducted into the cylinder for the combustion cycle and is a combination of fresh intake air and EGR).

48. A further benefit of EGR is that it can cause the intake charge to have a higher specific heat capacity than that of pure air, leading to a lower final gas temperature for the same

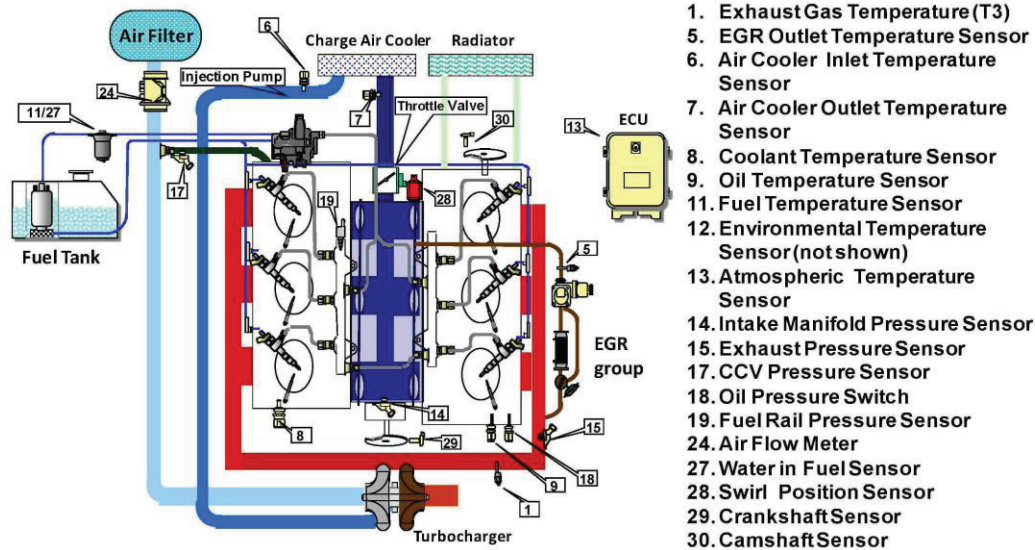
amount of heat addition during the combustion process in the cylinder. This combination of reducing the oxygen concentration in the cylinder charge along with reducing its maximum potential temperature for the same heat addition, has a positive effect on reducing the gaseous NO_x formation in-cylinder during the combustion process.

49. Unfortunately, under high EGR rates, while NO_x production can be kept suitably low, the dearth of oxygen in the cylinder, coupled with the somewhat lower combustion temperatures, can lead to elevated PM, CO and HC emissions, with high PM emissions rates being the most deleterious effect of elevated EGR rates. Furthermore, any elevated rates of PM, CO and/or HC implies that unburnt fuel (or partially oxidized fuel) is being emitted from the engine – and this constitutes an undesirable detriment to the fuel efficiency of the diesel engine. Elevated PM due to high EGR rates and the concomitant reduction in fuel efficiency potential is normally to be avoided through adequate control and calibration processes and procedures.

50. Typical EGR rates vary with engine operating conditions, from zero, when no charge dilution is required or desired, to as high as 50% (or more) when significant NO_x reduction rates are required, specifically to meet prevailing applicable vehicle exhaust emissions standards.

AUXILIARY EMISSIONS CONTROL FEATURES

V6 diesel engine – Engine mechanization drawing, with EGR system and sensors position



Chrysler Group LLC Confidential – Rev 7-23-2013

Page 56

Confidential

Confidential Business Information

2016FCA0000689
FCA-PIRNIK-001039229**I. Selective Catalytic Reduction**

51. Selective catalytic reduction (SCR) in the case of diesel engine exhaust emissions refers to the reduction of NO_x (downstream of the engine) to its elemental nitrogen and oxygen, through the use of a further chemical reagent, in this case aqueous ammonia as contained in liquid urea (a small amount of carbon dioxide is also co-produced in this urea-based NO_x reduction reaction but not in significant quantities).

52. The urea is contained in diesel emissions fluid (DEF) and is normally stored in a tank on board the vehicle, and is required to be replenished by the vehicle operator periodically

emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use...”, (unless certain exceptions—not applicable here—apply.) As the T_Engine is designed to accomplish exactly this — a reduction of the effectiveness of emission control systems under ordinary real-world driving conditions — T_Engine is clearly a “defeat device” as contemplated in 40 CFR § 86.1809-12.

110. The presentation (FCA-PIRNIK-001679820-833) makes clear that the T_Engine is designed to cheat the emission test cycle because the end result of this feature is that “the IRS will be functional for approximately 20 minutes per day, so long as the vehicle is operated in conditions which are similar to the emissions test conditions.” *Id.* at 822. This presentation is discussing the use of this feature in FCA vehicles sold in Europe (the sale of such diesel-powered vehicles pre-dated their development and sale in the United States). Emissions tests in Europe for light-duty vehicles at this time lasted slightly under 20 minutes on the New European Driving Cycle (or “NEDC”). Thus, as explained in the presentation, the T_Engine feature is designed to have the relevant emission control system run only during the emission test and then shut off. And because real-world driving is more aggressive than the test procedures, the emissions controls will shut off even sooner than 20 minutes if the vehicle is driven on the road. Mr. Palma testified that the name of the software feature described in the presentation, “EngDa_tEng” was same as that in the Subject Vehicles. Palma Tr. At 53:21-54:2.

111. Thus, as early as April 2010 the use of a modeled or calculated engine temperature using an offset to the coolant temperature that is modified based on the total quantity of fuel injected over time, as opposed to using the actual measured coolant temperature (as measured by the physical sensor that actually existed on the engine), was identified by VM (at

least) as a cycle detection device, and hence a defeat device. By June 2010 (only two months later), the T_Engine function had been presented to FCA and was being incorporated into the Subject Vehicles in the United States to allow for the management of the EGR rate by the engine control system. FCA-PIRNIK-001494623. In a June 8, 2010 email from Sergio Pasini to Antonio Baccarini, Matt Lipkowitz and Spencer Schipper, Mr. Pasini wrote “we all know (or we’ll know soon) the egr rate will be managed mainly on t-engine which, **no matter what Fiat says, a cycle detection**, for high (or low) HFM temp **we won’t have egr rate since it’ll be already cut out by t engine.**” *Id.* at 625 (emphasis supplied).

112. As FCA began developing the Subject Vehicles, FCA senior management mandated that the vehicles be able to achieve a fuel economy target of 30 miles per gallon of fuel consumption, at least on the highway, or a target of “30 mpg.” B. Lee Tr. at 64:1-21. Bob Lee testified that the decision was made at a “Product Committee” meeting attended by him, Mr. Marchionne and other senior executives. *Id.* However, by November 2011 the 30-mpg target was at “high risk”. Specifically, on November 28, 2011, Larry Nowak, Luca Sabbioni and Don Altermatt (the “team leader” for the project team developing the Subject Vehicles (B. Lee Tr. at 2812-17)) met with Bob Lee to provide an update on the development of the engines for the Subject Vehicles. FCA-PIRNIK-001083145. That presentation stated that the 30-mpg highway target was at “high risk” because the vehicles were at that time achieving only 26.5 mpg on the highway. *Id.* at 166, 183. As a result, Mr. Lee created a special task force to ensure 30.0 mpg was achieved. *Id.* See also B. Lee Tr. at 72:19-73:1.

113. Immediately thereafter, the team working on the Subject Vehicles began looking for ways to increase the “engine out” NOx in order to increase fuel economy, knowing that there is a distinct relationship between high engine-out NOx emissions and high fuel efficiency. FCA-

121. Clearly from its definition and the fact that FCA documented the output of the T_Engine function compared to the actual engine coolant temperature, the T_Engine was designed to invoke engine control system behavior that was not the same as if the control system behavior had been invoked by the actual measured coolant temperature. This is not normal practice in engine control or calibration operation, and begs the question as to why should a surrogate (calculated or derived) parameter be used when the directly measured actual parameter was clearly available.

122. In a February 1, 2012 email, Steffen Moessner of Bosch asked Emanuele Palma whether the T_Engine (“Temp Model”) was used only to adjust the “EGR base map” or “do you adjust other parameters which will impact exhaust temperature (e.g. injection timing, injection pattern, etc)?” FCA-PIRNIK-001054192, at 196. Mr. Palma responded, “we are planning to use the engine temp model instead of the actual coolant temp as an input of the EGR rate/AirMass correction maps only, no plans to do the same for any other strategy.” *Id.* at 195.

123. As T_Engine was described by Palma to adjust the “EGR base map” (at a minimum) it is clearly an AECD, as it certainly affects engine exhaust emissions (specifically of NOx in the case of adjusting the “EGR base map”), and as such was required to be divulged, disclosed or reported to the EPA and CARB in the application for Certificate of Compliance of the Subject Vehicles.

124. By January 31, 2012, FCA was using the T_Engine function (and vehicle speed correction AECDs, *see infra* at ¶¶ 155-183) in the testing of the Subject Vehicles and Bosch was raising concerns as to the legality of the T_Engine feature. FCA-PIRNIK-001353745; FCA-PIRNIK-001530757. On January 24, 2012, Mr. Giorgio Zacchi emailed Michael Berry at Robert Bosch USA a copy of “the T_engine explanation I presented last week to the people taking care

of the homologation here in Chrysler.” FCA-PIRNIK-001353745, at 749. The group taking care of homologation at Chrysler was the Certification Group headed by Roger Orteca. Palma Tr. at 123:13-124:13. Mr. Berry immediately raises Bosch’s concerns:

“After sitting and reviewing the T-eng software model, **we have some concerns with getting this past CARB / EPA.**

1. **The negative offset is a red flag.** Why would the combustion chamber temperature ever be below ambient after a long soak. Coolant, chamber, and ambient will all be equal.
2. You describe T-Eng as the actual temperature inside the combustion chamber. **In reality, the combustion chamber should be warmer than the coolant.**

These are going to be issues raised when you present this AECD. CARB / EPA will want to know where you are running this correction. If you are using it as a cold start improvement, it should be primarily active at cold temps and becoming less active as the ambients increase. **If they see it active only during an FTP-75, they will for sure deny this.**

Our suggestion would be to take this presentation to the Chrysler AECD experts and see if they approve it.”

Id. at 748 (emphasis supplied). Mr. Berry’s concerns in this email are an attempt to understand the logic behind using a calculated or derived engine “temperature” while there exists an actual measured engine coolant temperature available from the engine itself. First, if the “T-eng” is related to the combustion chamber temperature (where the combustion chamber wall is exposed to the in-cylinder combustion gases on one side and the engine coolant on the other), that calculated temperature should never be below the measured coolant temperature. Second, once the engine has been started, the combustion chamber temperature should always be above the temperature of the engine coolant (which by definition cools engine components heated by the combustion process). For these reasons, Mr. Berry saw the “T-eng” for what it was, namely an attempt to develop a calculated contrived “engine temperature” value that could be used to adjust the engine and aftertreatment control in a different fashion on the FTP-75 versus in real-world

driving conditions and operation. The term “a long soak” refers to the phenomenon in which hot components in the engine or ATS cool down (thermally “soak”) after an engine is turned off (while cooler components might warm up) until after some extended elapsed time (normally measured in hours), the temperature of all of the various engine and aftertreatment system components end up at or near the prevailing ambient (air) temperature.

125. In a January 31, 2012 email, Mr. Lipkowitz wrote to Messrs. Palma, Foriani, Zacchi, Vicedomini, Pasini and Padovan further explaining Mr. Berry’s concerns:

“Now, on to the concerns on tEng. Based on the presentation shared by Giorgio, the tEng is described as a modeled warm-up which lasts for a short time. Below is the picture of Phase 1+2 on the 3128 with 98C thermostat. Mike’s experience with CARB and based on the understanding of the presentation, the tEng should come together with the coolant temperature when the T-stat starts to open, which occurs at 740-750 sec in below picture. Our current cal has the tEng almost together with the coolant (still with some offset) at the end of Phase 2, and would raise a lot of red flags with CARB – even if we’re only modifying the EGR rate and not shutting off the EGR completely. ... Also, **the tEng working at the warm re-start is a clear red-flag to CARB as well and can’t happen.**

Now, ultimately **this has to be reviewed by the Chrysler cert group as to how the logic is actually working.** This not is just to express Mike’s concern about the logic, so that we don’t potentially face issues in the near future.

I asked for his professional opinion on the vehicle speed correction as well, they haven’t looked at it so much so there isn’t feedbacks at this time.”

FCA-PIRNIK-001530757, at 760 (emphasis supplied).

126. The concern that Mr. Lipkowitz is describing here is that while FCA is attempting to present T_Engine as a feature used for a brief time just to warm up the engine (before the thermostat opens), the testing shows that it is clearly used much longer than that, reinforcing its activity as a defeat device. In an engine that is warming up from a cold ambient temperature (“cold start”), particular engine control actions are required and used to warm up the engine in an expeditious fashion in order to ensure the earliest onset of good, stable combustion and smooth

engine operation under load. In addition, the ATS is required to be warmed up into its most efficient operating range by the heating action of the exhaust gases flowing out of the engine, in order to ensure that the exhaust emissions being produced by the engine (most notably NO_x in this case) are remediated in an efficient fashion by the SCR device. For that reason, most engine control systems employ various strategies to ensure swift engine warm-up. In addition to engine control strategies, a very common method is to use a mechanical device known as a thermostat (here designated as “T-stat” by Lipkowitz) to reduce or prevent coolant flow from the engine (undergoing warmup) to the radiator which is itself designed to remove heat from the coolant. Once the coolant temperature in the engine, heated by being circulated around the outside of the combustion chamber(s), for example, exceeds a certain temperature the thermostat, which is entirely passively and internally controlled, “starts to open” – at that point allowing the circulation of all or part of the coolant to the radiator, where it is cooled and then recirculated to the engine. If the “T_Engine” calculated temperature was designed to mimic the engine temperature, then, Lipkowitz appears to state, T_Engine should converge on the actual coolant temperature at around the time that the thermostat itself opens and allows the coolant to circulate around the cylinder liners (rather than being prevented from circulation in the coolant loop that includes the vehicle’s radiator). In other words, Lipkowitz was stating that if the “T_Engine” parameter was developed because the actual coolant temperature took some time to approach the temperature of the outside of the cylinder or combustion chamber, then the actual coolant temperature and the combustion chamber temperature should converge once the thermostat was opened. For this reason, on the hot restart of the engine (“warm re-start”), in which the thermostat immediately opens (or has remained open without closing), there should be no reason to employ the T_Engine parameter in preference to the actual measured coolant temperature.

127. The “Phase 2” referred to by Mr. Lipkowitz is the second time phase of the FTP cycle, which for the purposes of descriptive convenience is typically divided into 3 separate time-based phases (1, 2 and 3) by engine control and calibration engineers. In addition, during emissions testing over the FTP, three (3) bags of exhaust gas samples are collected for later chemical analysis, and these 3 bags are in most cases individually collected over each of the 3 time-based phases of the FTP (as a result, the phases of the test cycle are sometimes referred to as “bag 1”, “bag 2” and “bag 3”). The distribution of emissions across the 3 phases of the FTP is important as an indicator of the efficacy of the engine control and calibration (and the ATS efficiency) as a function of engine and vehicle operation, as well as time and the trajectory of the engine temperature since start (cold start, warm re-start or hot start).

128. In response, Mr. Palma expresses his own concern about developing this feature (and others) that Bosch and VM Motori were saying were improper but FCA/Chrysler, the entity ultimately responsible for the vehicles, did not care.

“I have mixed feelings about this: on the one hand during all the several meetings we’re having with the people in Chrysler dealing with the certification group they basically smile when we tell them our concerns about these strategies and they only want a general explanation with no description on how we’re actually going to calibrate it. They even say they don’t think they’re going to bring it to the attention of the EPA.”

FCA-PIRNIK-001530757, at 758 (emphasis supplied). Mr. Palma testified that “the people in Chrysler dealing with the certification group” were, among others, Anthony Baccarini, Don Altermatt, Amit Sinha and Larry Nowak. Palma Tr. at 111:5-16. The “certification group” referred to Roger Orteca and his team. *Id.* 40:15-21.

129. After another conversation with Mr. Berry, Mr. Lipkowitz provided more details of the concerns, stating that it could be permissible if it operated only for a very short period of time, “However, when he looks at a .dat file and sees the tEng dropping below the coolant at the

Ph3 restart, then it doesn't make plausible sense and could potentially be called a cycle detection device." FCA-PIRNIK-001530757. "His suggestion is that a dat file showing the implementation should be showed directly to the AECD group to show them how long the tEng lasts during the Ph1/2 warm-up, and then also during the Ph3 restart warm-up. ... Ultimately the decision comes down the Chrysler on their expertise on what AECD would be accepted and not." *Id.* at 757-758 (emphasis supplied). What Mr. Lipkowitz is saying here is that he is concerned that the use of the T_Engine algorithm does not appear to be engine temperature (and engine coolant temperature) dependent, which is and was difficult to justify – "it doesn't make plausible sense" – and was likely to be called out as a "cycle detection device".

130. Mr. Lipkowitz emailed Mr. Berry back at the end of the day (January 31, 2012) stating "I sent the material to the homologation group at Chrysler. They're reviewing it. I'm going to meet them again about the AECF list, so maybe they'll tell me what they think about." FCA-PIRNIK-001353745, at 747 (emphasis supplied).⁴

131. The VM Motori group decided to present the issues to FCA with all three entities together (FCA, VM Motori, and Bosch) with the goal of making sure that FCA was well aware of the concerns and risks and if they were questioned by the EPA or CARB, they would all tell the same story. *Id.* at 746. Mr. Palma suggested that they all present the concerns to Roger Orteca of FCA's Certification Group during the standing weekly meeting they have with him. *Id.* at 745. But Mr. Palma makes clear that FCA's Certification Group and Bob Lee were well aware of the feature and their concerns: "we have done so far without anyone in Chrysler raising any objections, all these strategies were presented to Bob Lee as approved by the cert group. Maybe we could also invite Mike Berry to the next meeting so that all three parties can

⁴ Mr. Berry similarly raised concerns about the adjustment to EGR based on vehicle speed. FCA-PIRNIK-001353745, at 746. *See infra* at ¶ 167.

speak openly about the matter.” *Id.* at 746 (translation) (emphasis supplied). Mr. Vicedomini stated that the T_Engine and reduction of EGR based on vehicle speed were necessary if FCA wanted the vehicles to get 30 mpg. *Id.* at 745 (translation).

132. In a February 1, 2012 email from Steffen Moessner of Bosch, he asked Emanuele Palma whether the T_Eng (“Temp Model”) was used only to adjust the “EGR base map” or “do you adjust other parameters which will impact exhaust temperature (e.g. injection timing, injection pattern, etc)?” FCA-PIRNIK-001054192, at 196. Mr. Palma responded “we are planning to use the engine temp model instead of the actual coolant temp as an input of the EGR rate/AirMass correction maps only, no plans to do the same for any other strategy.” *Id.* at 195.

133. As T_Eng is described to adjust the “EGR base map” (at a minimum) it is clearly an AECD, as it certainly affects engine exhaust emissions (specifically of NOx in the case of adjusting the “EGR base map”), and as such is required to be divulged or reported to the EPA in the application for certificate of compliance.

134. The above email exchange is sent to Michael Berry who, on February 1, 2012, informed the team that T_Eng was an illegal “cycle detection” and “defeat device.” FCA-PIRNIK-001054192, at 194-195.

“I’ve learned a little more about this T_Eng functionality during the test trip and have now seen the ranges in which it will be used. During the FTP-75, the T_Eng functionality is used for roughly 1200 seconds of the 1400 second test (bags 1 & 2). During the third bag, the T_Eng offset is again used for the entire bag. **Using this method to alter the engine airflow and EGR rates while on the FTP-75 is clearly a method of detecting an emission cycle.**

By using the functionality, the EGR flows are being altered while on an FTP test and running a different value in the real world. This is an emissions defeat device and must be clarified to Chrysler AECD....

If this method is found to be a cycle detection, CARB / EPA will have serious penalties.”

Id. at 194-195 (emphasis supplied). As the Bosch communication suggests, the use of “T_Eng” to “alter the engine airflow and EGR rates” is by its very definition an AECD, and as such was required to be disclosed to the EPA. Secondly, by employing time as a variable in its calculation it is “clearly a method of detecting an emission cycle” and hence a method of “cycle detection”, and thirdly, by “running a different value in the real world” this constitutes “an emissions defeat device”.

135. Mr. Palma responded to Mr. Berry’s email, stating that FCA is aware of the issue but wants to use it nevertheless: “Thanks for your comments, we’re working closely with Chrysler and the feedback we’ve had so far about the usage of this feature is positive. We will keep developing our calibration using this temperature model as one of the inputs of the EGR rate / Air mass setpoint formation...Last, Chrysler and VM would like not to have this topic added to the open point list you share with Doug Stander and the rest of the team for the moment, Antonio would rather mention it to him before discussing it further with you and all of us.” *Id.* at 194 (emphasis supplied). Mr. Berry stated “I will leave this item for VM to address with CHR.” *Id.* On February 2, 2012, Mr. Berry warned that using the T_Engine feature would also violate the OBD regulations: “If we continue with the planned TEng, we will require software changes in order to not use this label. If we enable diagnostics with the TEng temperature, we will not be OBDII compliant.” *Id.* at 192 (emphasis supplied). Mr. Palma confirms that “We want to move forward with the tEng...” *Id.* (emphasis supplied).

136. Mr. Palma testified that he specifically recalled raising the concerns about T_Engine with Roger Orteca, the head of FCA’s Certification Group, as well as Donald Altermatt, team leader of the Subject Vehicle project, and Antonio Baccarini. Palma Tr. at 99:13-101:8. He met in person with Mr. Altermatt in Mr. Altermatt’s office and told him about the

concerns that Bosch had. *Id.* at 102:3-103:23. Mr. Altermatt told him that FCA had “already discussed this with the certification group.” *Id.* 107:24-25. Shortly thereafter, Mr. Palma met with Mr. Orteca in a conference room in the Auburn Hills Tech Center and told him that Bosch had concerns about the usage of T_Engine. *Id.* at 103:25-106:3. Mr. Palma went to Mr. Orteca “specifically to reconfirm approval of using tEng.” *Id.* at 105:18-19. Mr. Orteca was already aware of the T_Engine feature (*id.* at 108:20-22) and “he confirmed that tEngine was a software in the calibration that could be used.” *Id.* at 106:1-3.

137. In response to the determination that T_Engine would in fact be used on the Subject Vehicles, on February 2, 2012, Bosch raised the issue that utilization of T_Engine would require a software change that would result in an additional cost to FCA presumably to be incurred by using additional Bosch engine and ATS control and calibration capability. Mr. Palma writes, “Tell Mike Berry to write the SCR’s, then we’ll go to Chrysler saying: **that’s what you need if you want 30 mpg.**” FCA-PIRNIK-001054192 (emphasis supplied). (“SCR” in this context is taken to mean ‘software change request’, a method of formalizing a request for a modification in SW sent from a customer (FCA in this case) to an engine control software supplier (Bosch in this case)).

138. On February 27, 2012, when asked about the use of the T-Engine feature, Michael Berry stated “**This is a cycle detection VM is using to get fuel economy by altering the EGR flows. I’ve warned them about the impacts of cycle detection, but they wanted to move forward with it. This is why the OBD team is going to request SE changes to ensure we are not caught in their web.**” RBL-15CV07199-PE-000001687.

139. The T_Engine feature and the alarms being raised internally (and externally at Bosch) remained the same through FCA’s submission of the COC Applications for the Model

Year 2014 Subject Vehicles in the Summer of 2013. Indeed, additional evidence that T_Engine was an impermissible defeat device is the fact that the input to the OBD system diagnostic algorithms was deliberately made to be the actual measured coolant temperature (and not the Modeled Engine Temperature / T_Engine as in the case of the engine and ATS control and calibration software). Palma Tr. at 148:6-15; FCA-PIRNIK-001039501. For example, in FCA-PIRNIK-001039501 the Chrysler Group LLC 2014 Application for Certification shows a list of “Auxiliary Emissions Control Functions”, including (at 605) “Software Feature OBD Monitors #2”. This “AECF” (not “AECD”) shows under “Inputs” the parameter “Coolant temperature” as opposed to ‘calculated temperature’ or ‘derived temperature’ or ‘T_Engine’ or ‘T_Eng’ or ‘T_eng’. If the actual measured coolant temperature was suitable and adequate for OBD purposes, it would be suitable for engine and aftertreatment control purposes. This very disconnect (between using T_Engine for emissions control but actual physical measured coolant temperature for the OBD monitors) was raised in June 2013. It was determined that the application for Certificate of Conformity documents should not mention T_Eng because the EPA (and potentially CARB) would consider it a cycle beating defeat device. So, instead, the OBD monitors used actual measured coolant temperature instead of the modeled or calculated engine temperature derived by the T_Eng algorithm or strategy, thereby preventing the T_Engine defeat device from being discovered during any review of the OBD software monitors

140. On June 18, 2013, Michele Padovan (VM Motori) emailed Emanuele Palma, Matt Lipkowitz, Marco Forlani, Rocco Vicedomini and others, all of VM Motori:

“The bigger concerns are...**in the CERT docs tEngine is not mentioned, since if CARB found about that it would be probably considered as cycle beating.** On the other side, the cert docs need to reflect the actual enable conditions, so even not mentioning explicitly t engine we could get questions and maybe they could found about it.”

FCA-PIRNIK-001333796 (emphasis supplied). *See also* FCA-MDL-000295192 (MDL Ex. 86) (“The only strategies mentioned for the EGR are correction based on environmental temperatures and pressure, nothing that in my opinion could put us in trouble...There’s no mention of the t engine in the AECD.”); FCA-PIRNIK-001440175; FCA-PIRNIK-001440177 (June 18, 2013 email and attachment discussing meeting about T_Engine: “Enable conditions now linked to Teng – CARB risk of detection of Teng”, “Engda_Teng – Risk of CARB disclosure .. Monitoring strategy differing from disclosed enable conditions”). Addressing this issue, on June 19, 2013, Mr. Berry writes: “the biggest concerns are the IUMPR for these monitors and the potential definition of the Teng functionality. With monitors being dependent on a cold or warm start for completion, this results in the cert docs not matching the actual control strategies.” FCA-PIRNIK-001353323, at 326. In response, Mr. Padovan writes: “Another important point is related to the cert docs. Can you share these contents and the changes you would need to make with the Cert Docs team, so they can start thinking about the best way to disclose the enable conditions keeping away from the t engine.” *Id.* at 325. Mr. Berry responded to Mr. Padovan’s suggestion that they not disclose the T-Engine feature in the certification documents: “As for Teng declaration, I don’t know that there is much possible around it. If Teng is used as an enable condition (even as a secondary – ie ZFC [“zero fuel quantity calibrator”] control activates on Teng and therefore the ZFC monitors activate on Teng), **there is a high risk that the declaration will be required.** Judging from the level of details CHR requires and that CARB is asking for, **the discussion will likely go deep enough to expose this strategy.**” *Id.* at 324 (emphasis supplied). Mr. Palma responded, **“I would like to have the strategy active but I don’t want to disclose the t engine.”** *Id.* at 323 (emphasis supplied); *see also* Berry Tr. 185:21-193:11. This reinforces the fact that the “Teng” or “T_Eng” algorithm was

clearly a defeat device, and that key members of the Subject Vehicles' control, calibration and diagnostics development team were concerned about the likelihood of discussions that might "expose this strategy".

141. As described above, the reason that T_Engine was not used for the OBD monitors by FCA (or not disclosed as such) was that the operation of all of the OBD monitors was required to be disclosed to the EPA and CARB, and the regulators' engineering staff would have noticed (i) if any critical diagnostic monitor was not disclosed, and (ii) if any monitor disclosed had a calculated engine coolant temperature as an input and not an actual measured engine coolant temperature. The CARB and EPA staff would possibly have enquired as to why a calculated engine temperature was used, while the disclosure of AECDs for the certificate of compliance, while compulsory, is left up to the OEM to perform. (It is not readily apparent if all of the OBD monitors disclosed to CARB and EPA actually use the measured engine coolant temperature or not, as stated by Berry, Padovan, Palma and others, but at least some are reported in the application for COC documentation to do so. See for example, FCA-PIRNIK-001039501).

142. The version of T_Engine that was installed on the Subject Vehicles remained substantively the same, FCA-PIRNIK-001641314 (letter from FCA to EPA stating FCA's emission control strategies for all three model years of the subject vehicles "are largely the same ... with the only differences being minor changes in the calibration values for certain of the strategies"). In February 2014, well after the Model Year 2014 Subject Vehicles were on the road, the team was discussing "refining tEng corrections" for the 2015 Model Year. FCA-PIRNIK-001175168. Mr. Berry again raised his concerns about doing even more cycle detection through T_Engine: "I'm doubting why we need to add more correction when we already have a 35% reduction in the EGR rate for warm engine. I'm also doubting the impact that it will have

on urea consumption which is already precarious...**I'm not really comfortable increasing the amount of cycle detection that we are doing already which is already pretty unjustifiable.**"

Id. (emphasis supplied). This "discomfort" was understandable based on the fact that as far back as 12 December 2011 Lipkowitz was informed by Rocco Vicedomini (1206702) that "we need to introduce a sort of "cycle detection"" and then mentions "the introduction of the tEngine..Anyway we can try something "special" for NAFTA..." FCA-PIRNIK-001206701, at 702.

143. When questions were raised as to the impropriety of the T_Engine feature and replacing it with the appropriate actual measured engine coolant temperature, those ideas were rejected because of the benefit T_Engine had to the fuel economy. For example, on July 16, 2014 Mark O'Donovan, lead calibration engineer for FCA on the Subject Vehicles, asked what the impact would be of switching to coolant temperature because "I am concerned for future MY, tENG is questioned for NAFTA applications and we may anyway have to use cENG." ("cENG" is taken to refer to the actual measured engine coolant temperature). FCA-PIRNIK-001456289. In response, Mr. Palma stated "FE [fuel economy] impact is probably around 2 mpg highway." *Id.* When Mr. O'Donovan suggested that they talk one-on-one to see if the software needs improvement, Mr. Palma responded: "**Chrysler knows tEng is the only way to get to 30 mpg, so don't worry about this topic.**" *Id.* (emphasis supplied).

2. T Engine Is An AECD That FCA Failed To Disclose and Is A Cycle Detecting Defeat Device

144. The U.S. regulation (§86.1844 [d][11]) requires manufacturers to submit to the EPA at the time of their application for a certificate of conformity "A list of all auxiliary emission control devices (AECD) installed on any applicable vehicles, including a justification for each AECD, the parameters they sense and control, a detailed justification of each AECD

150. This excerpt from the MY 2014 COC Application specifically shows that the “EGR opening delay” in this case is a function of “coolant temperature” and/or “Engine Temperature [°C]”. No mention is made of the use of any calculated engine or coolant temperature as an input to this EGR algorithm or strategy.

151. My conclusions are further supported by the findings of the EPA and CARB as well as Bosch as discussed below, *infra* at ¶¶ 346-394.

152. My conclusions are further supported by the conclusions of the EPA that none of the information, explanations or justifications provided by FCA as to any of the undisclosed AECDs prior to the EPA issuing the January 12, 2017 NOV or filing the EPA Complaint on May 23, 2017 (“EPA Complaint”) demonstrated that any of the AECDs was not a defeat device. *See* NOV at 6 (“To date, despite having the opportunity to do so, FCA has failed to establish that these are not defeat devices.”).

153. The EPA also concluded: “To date, despite having the opportunity to do so, FCA has failed to demonstrate that FCA did not know, or should not have known, that a principal effect of one or more of these AECDs was to bypass, defeat, or render inoperative one or more elements of design installed to comply with the emissions standards under the CAA.” NOV at 6.

154. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

B. “AECD #1” and “AECD #2” – EGR Shut-off / Reduction At Highway Speeds

155. Under AECD #1 and AECD #2, the EGR rate of the Subject Vehicles is reduced at vehicle speeds of “greater than 100 km/h” (FCA-PIRNIK-001040703), which corresponds roughly to 62 mph. In the MY14 Subject Vehicles, the vehicle speed correction to the EGR was an absolute offset to the EGR rate, reducing and potentially completely shutting off the EGR. In the MY15 and MY16 Subject Vehicles the vehicle speed correction to the EGR was a percentage reduction in the EGR rate. FCA-PIRNIK-001621314, at 318.

156. This feature has the effect of reducing the EGR to the engine, which – all else being equal – will lead to higher in-cylinder NO_x production and hence higher engine-out NO_x emissions. Thus, this feature is an AECD that was required to be disclosed as it affected vehicle emissions.

157. The vehicle speed of 62 mph that corresponds to this feature’s initiation or actuation is higher than the maximum speed reached during any of the FTP-72, FTP-75 or the HWFET test cycles. If the additional NO_x that is produced while this AECD is in operation (namely at all vehicle speeds above 62 mph) is not adequately remediated by the ATS, the tail-pipe NO_x level will certainly be higher than the expected tail-pipe NO_x emissions level in the absence of the activation of this AECD. Without adequate downstream control interventions (such as the injection of additional DEF into the SCR, assuming that the SCR device is operating with sufficient conversion efficiency to allow for the adequate reduction of the NO_x produced by the engine), this AECD will certainly increase tailpipe-out vehicle NO_x emissions levels. These levels will certainly be above the levels seen while the vehicle is being operated over the FTP or

features are AECDs and defeat devices is further supported by the actions of CARB. By mid- to late-2014, CARB had contacted FCA regarding its concerns about AECDs that reduce or shut-off the EGR, focusing specifically on “EGR #9” and “EGR #12” indicating that AECD #1 and AECD #2 were AECDs that required disclosure and could be of particular concern to FCA’s regulators. FCA-PIRNIK-001053122. CARB had even determined that another AECD that shut off the EGR outside of engine starting was a “defeat device.” FCA-PIRNIK-001056636 (discussing EGR #12). Indeed, CARB told FCA that justifications for EGR shut-off needed to be reviewed by higher management at CARB for approval. FCA-PIRNIK-001616051 (discussing EGR #12).

178. My conclusions are further supported by the conclusions of the EPA that none of the information, explanations or justifications provided by FCA as to any of the undisclosed AECDs prior to the EPA issuing the NOV or filing the EPA Complaint, demonstrated that any of the AECDs was not a defeat device. *See* NOV at 6 (“To date, despite having the opportunity to do so, FCA has failed to establish that these are not defeat devices.”).

179. The EPA also concluded: “To date, despite having the opportunity to do so, FCA has failed to demonstrate that FCA did not know, or should not have known, that a principal effect of one or more of these AECDs was to bypass, defeat, or render inoperative one or more elements of design installed to comply with the emissions standards under the CAA.” NOV at 6.

180. My conclusions are further supported by the fact that FCA’s failure to disclose this AECD also was in violation of FCA’s own stated policies for disclosure. FCA-PIRNIK-001622311, at 312-313.

181. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

182. AECD #1 and AECD #2 certainly, by reducing EGR rates at certain vehicle speeds would have increased engine-out NOx emissions. These features would subsequently also have increased NOx emissions from the Subject Vehicles in normal real-world driving conditions, unless those excess engine-out emissions were remediated by higher DEF injection rates in the ATS, all else being equal.

183. AECD #1 and AECD #2 certainly caused the vehicle, engine and ATS emissions controls of the Subject Vehicles to perform differently in laboratory testing that they did on the road in real-world driving conditions.

C. “AECD #3” – EGR #12 (Valvetrain Cleaning Routine)

184. EGR #12 completely shuts off the EGR function for five minutes after thirty minutes of driving every drive cycle (and engine rpm >1000). FCA states that the purpose of this feature is to clean “potential” deposits on the valve stem and valve seat that, due to specific mechanical engine design considerations, “could lead to a non-complete exhaust valve closing.” Incomplete valve closure could lead to engine instability and “shuddering”. *See* FCA-PIRNIK-001595192-250, at 240.

routine; he rather laughed in our faces, but that's fine." Palma Tr. at 194:14-17; FCA-PIRNIK-001699742 (translation). Mr. Palma circulated the description of EGR #12 that states that this feature will result in an increase in NOx and that that it is not "Substantially included in the FTP Test". *Id.* As Mr. Palma testified: "I remember that someone from VM, and it might be me but I don't remember, did provide it to Roger or a person in Roger's group. Palma Tr. at 189:11-13. Mr. Palma testified that the write up was provided either to Mr. Orteca, Mr. Kopinski, Mr. Shaw or Ms. Borland. *Id.* at 189:20-24.

199. Notably, an internal list of AECDs on the Subject Vehicles dated July 23, 2013 from the files of Beth Borland and Gerald Kopinski, who worked for Roger Orteca in FCA Certification Group, includes EGR #12, acknowledging that it increases NOx emissions and it is not included on the FTP Test. FCA-PIRNIK-001798688, at 737.

200. EGR #12 was not disclosed in FCA's application for COC for the MY14 Subject Vehicles or the running change submitted on October 4, 2013. FCA-PIRNIK-001621314, at 318; FCA-PIRNIK-001039086, FCA-PIRNIK-001039501, FCA-PIRNIK-001038576, FCA-PIRNIK-001038820, FCA-PIRNIK-001416772.

201. Even though FCA had another year to incorporate into the MY 2015 Subject Vehicles one of the several hardware fixes it previously identified, FCA kept using EGR #12 instead.. B. Lee Tr. at 119:18-120:5.

202. EGR #12 was not disclosed in FCA's application for COC for the MY15 Subject Vehicles submitted on June 12, 2014. FCA-PIRNIK-001621314, at 318; FCA-PIRNIK-001039658.

203. In July or August 2014, CARB contacted FCA regarding EGR #12 and cited its opinion that this constituted a defeat device. E.g., FCA-PIRNIK-001040178 (August 10, 2014

presentation discussing CARB's concerns regarding EGR #12); FCA-PIRNIK-001256222 (August 27, 2014 email concerning comments from CARB: "turning off EGR for 5 minutes after 30 minutes of operation on every drive cycle appears excessive"). It was only after CARB raised questions about FCA's AECD list in July or August 2014 (a year after it had been installed, and after the COC had been granted) that FCA updated the AECD list for MY 2014 on October 13, 2014 and for MY 2015 on October 9, 2014. FCA-PIRNIK-001621314, at 318; FCA-PIRNIK-001039297, FCA-PIRNIK-001039842.

204. On October 1, 2014, Dan Hennessy emailed Steve Mazure, Ellis Jefferson, Emanuele Palma and Mark O'Donovan regarding CARB's questions about AECD #3. In response to CARB's question "What is the emission impact when running this test?" Mr. Hennessy wrote "We have not collected emission data while this feature is active. Our assessment is that the engine out NOx emissions will increase significantly (>2 times) for the 5 minutes that the cleaning routine is active." FCA-PIRNIK-001040943; at 945.

205. CARB informed FCA that AECD #3 did not meet any of the exceptions that would designate it as not being a defeat device. In particular CARB determined that AECD #3 was not necessary for the protection of the engine. Du Nguyen (CARB) told FCA "**We believe problems of sticking exhaust valves that require regular EGR shut-offs are symptomatic of design weakness** in, for example, valve design/material/treatment, combustion chamber design, calibration, etc. **There are no such requests from other manufacturers. We have a dim view regarding this proposed AECD.**" FCA-PIRNIK-001040943; at 945 (emphasis supplied).

206. On October 2, 2014, the email chain was forwarded to Larry Nowak, Bob Lee, Michael Dahl, Frank Fodale, Mark Shost as well, stating that another meeting was scheduled for that day. FCA-PIRNIK-001040943; at 944. After that meeting, Mr. Nowak emailed Mr. Mazure

and Mr. Hennessy, asking “Steve, any additional insight beyond your comment about CARB not accepting the AECD? ... What was your read? They were firmly against it? I need to give Bob Lee an update tonight with this situation, so any words appreciated...” FCA-PIRNIK-001040943 – 944. Later that day, Mr. Mazure responded to Mr. Nowak, copying Messrs. Hennessy, Burns, McDonald and Elizabeth Krear, stating “**they still consider this EGR#12 calibration feature ‘a defeat device’ since we have provided them no emissions data justification of what happens during the EGR shutoff (5 minutes off for every 30 minutes driving to clean the valve). ... Yes, they are firmly against it...**” FCA-PIRNIK-001040943 (emphasis supplied).

207. On October 7, 2014, Steve Mazure provided another update to others at FCA, including Scott Kunselman, Vaughn Burns, Reginald Modlin, Morrie Lee, Emanuele Palma, Roger Orteca, Larry Nowak and Dan Hennessey and the update was forwarded to Bob Lee, Michael Dahl, Mark Shost and others. Mr. Mazure wrote “Short answer is CARB did not accept, but want through C.O.B. today ... to kick it up one more level of Management ... for her possible assessment/approval of this calibration feature: **They cannot emotionally get past this package having a timer-based calibration that shuts off an emission control device (EGR) for every trip**, even though the engine valve sticking condition seen in some of the reliability fleet is rare. **They consider this a ‘defeat device’ and items similar to this require government approval to proceed.**” FCA-PIRNIK-001633506 (emphasis supplied). Mazure continues, “This was a late calibration feature addition to the 2014 MY WK/DS that CARB did not apparently notice with the change disclosure and have only now discovered it during the 2015 MY approval process. We are not going down that discussion path.” *Id.* at 507. In the forwarded message from Larry Nowak to Messrs. Lee, Dahl, Shost and others, Mr. Nowak repeats that **CARB “consider this a time-based defeat device.”** *Id.* at 506 (emphasis supplied).

208. As indicated in Mr. Mazure's email, AECD #3, which CARB told FCA was a defeat device was implemented on Model Year 2014 Subject Vehicles on the road. However, FCA never informed the public and Mr. Mazure stated to others in the above email that FCA did not want to remind CARB of that fact, presumably because CARB could force a recall. As Mazure said, "We are not going down that discussion path." *Id.* at 507. Emanuele Palma also discussed this issue, stating "Nobody want to talk about the vehicles that are already in the field. Because CARB admitted this was an oversight by them, Steve [Mazure] believes they will not force a recall campaign but the key here is not to mention this at all in any circumstances." FCA-PIRNIK-002026565; at 566. On the evening of October 7, 2014, CARB officially informed FCA that EGR #12 was not approved. FCA-PIRNIK-001040885; 886. Therefore, all the Model Year 2014 Subject Vehicles contained impermissible defeat devices. Steve Mazure sent the email informing FCA to, among others, Messrs. Kunselman, Nowak, Hennessy, Burns, Modlin, Morrie Lee, Palma, Orteca, and it was forwarded to Messrs. Bob Lee, Dahl, and Shost. FCA-PIRNIK-001045715.

209. Later on October 7, 2014, CARB confirmed that they would not grant FCA an Executive Order ("EO"), an exemption to allow FCA to continue to sell vehicles containing EGR #12 as it then currently existed. FCA-PIRNIK-001678334. Mr. Mazure sent the email to the same group of people identified above. *Id. See also* FCA-PIRNIK-001690899.

210. Ultimately, FCA altered the engine control, calibration, diagnostics and ATS software on subsequent Subject Vehicles to modify the implementation of EGR #12 to conform to the requirements set forth by CARB. Specifically, FCA asserted that EGR #12 was modified such that the EGR would be shut off for 5 minutes only when all of the following criteria were met

- 30 minutes of vehicle operation;
- Engine rpm > 1000
- The average SCR temperature is between 195C and 400C for more than 2 seconds;
- DEF dosing flow is below the max allowed limit for more than 9.76 seconds

FCA-PIRNIK-001208374, at 375-376.

2. The Valvetrain Cleaning Routine (EGR #12 / AECD #3) Is An AECD That FCA Failed To Disclose and Is A Cycle Beating Defeat Device

211. EGR #12 is an AECD because it is a feature which senses a parameter (in this case, time) for the purposes of “activating, modulating, delaying, or deactivating” the “operation of [] part of the emission control system”, namely the EGR system and/or the EGR valve (40 C.F.R. § 86.1803-01). My conclusions are further supported by the internal determinations of the project team working on the Subject Vehicles.

212. As FCA has admitted, it did not disclose to EPA or CARB the existence of EGR #12 for MY 2014 or MY 2015 Subject Vehicles until after CARB raised concerns about FCA’s AECD list in July or August 2014. FCA-PIRNIK-001621314, at 318. For example, FCA’s application for COC for the MY14 Subject Vehicles describes an AECD, EGR #4. In this description, the operation of the EGR valve is specifically adjusted as a function of the “engine temperature”, also described as “coolant temperature.” FCA-PIRNIK-001039211, at 212. The application does not disclose EGR #12 or that the EGR valve is adjusted based on a timer.

213. As FCA internally acknowledge at the time of its development and CARB and EPA concluded in their investigations in 2014 and 2015/2016, *see infra* at ¶¶ 346-387, EGR #12 increased the engine-out levels of NO_x, which also could not be remediated by the SCR system in all circumstances, thus resulting in elevated tailpipe-out NO_x emissions at least in certain circumstances.

“activating, modulating, delaying, or deactivating” the “operation of [] part of the emission control system”, the injection of urea.

230. Furthermore, as discussed below, Online Dosing is a defeat device because it “reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use.” As those working on the Subject Vehicles stated, Online Dosing was utilized to minimize the amount of dosing so that customers would not need to refill the urea tank as often, which reduced the conversion efficiency of the SCR and increased NOx emissions. Using Online Dosing or any other strategy merely to save DEF consumption without regard for its effect on tailpipe-out NOx emissions levels, is impermissible and renders the feature a defeat device.

1. Discussion

231. Concerns about the impropriety of Online Dosing were discussed at least as early as February 2013 when Kasser Jaffri first noticed that the Subject Vehicles had Online Dosing during a test trip with Michael Berry of Bosch. Jaffri Tr. at 67:22-25. Mr. Jaffri had never seen Online Dosing before. *Id.* at 68:3-9 1264671. FCA-PIRNIK-001468981, at 983. He noticed that while driving at highway speeds “**the dosing was not high** and the monitoring was not running” so “he want[ed] to review the AECD ... on this point, because **this could be a concern for CARB.**” *Id.* at 983 (emphasis supplied). In response to a February 11, 2013 email discussing Mr. Jaffri’s concerns, Mr. Palma wrote “There is a lot of attention on emissions vs. real world DEF consumption, **I’m afraid this could become an issue.**” *Id.* (emphasis supplied). Mr. Rocco responded

“At this point it is not clear to me which is the real target. Do we want to achieve the maximum efficiency of the SCR system in every env. conditions or do we want to stay within the DEF consumption that we are targeting? **I am afraid that the alternative precontrol in highway will be a common condition with very**

cold temperature (higher NOX level), while it is pretty unusual at 20C. Said that, **the dyno bench activity is not covering the whole picture**. It should be clear also to Bosch that we are not pushing the SCR system to its limit in all the environmental conditions.”

Id. at 982 (emphasis supplied). In response, Mr. Palma stated that while their goal is to reduce DEF consumption outside the emissions test cycle, they cannot tell their regulators that:

“The DEF consumption is a functional objective, dealing with CARB/EPA is clearly a higher level priority. In other words we cannot say we run very low dosing ‘off cycle’ because we want to meet the agreed refill change interval. Bosch doesn’t really care about the targeted efficiency, **the problem is with Kass (Chrysler) who believes this could be seen by CARB as a cycle beating strategy**; my comment about dyno activity is only related to avoid putting numbers in that are only calibrated on the road.”

Id. at 981-982 (emphasis supplied). Mr. Zacchi responded that **“There’s no mention of the alternative precontrol in the AECD, Cert group agreed not to have it, and add it only in case ARB comes back and asks.”** *Id.* at 981 (emphasis supplied). Mr. Zacchi pointed out that he had previously drafted an AECD disclosure for Online Dosing but “then I removed it since **Cert Group did not want it.**” *Id.* (emphasis supplied).

232. After the test trip when he first learned of Online Dosing, Mr. Jaffri raised his concerns with several individuals, including Hal Zatorski. *Id.* at 68:14-16. He had questions as to whether Online Dosing was being used properly. *Id.* at 68:17-25. As Mr. Jaffri explained, Online Dosing could be used to reduce DEF consumption – to reduce the amount of urea that is dosed or injected into the catalyst. *Id.* at 69:1-16. By doing this, the vehicle owner would not have to refill the DEF/urea as often, which can be costly and an inconvenience to the customer. *Id.* at 69:12-70:3. Programming a vehicle’s dosing strategy with the purpose of conserving DEF/urea and/or hitting consumption targets is impermissible and renders the feature a defeat device.

233. On or around February 18, 2013, Mark Frank wrote to Hal Zatorski: “Morning! R u avail at noon to discuss together with Kass[er Jaffri] & me? Re: **VM lowers their Urea dosing rates during off cycle event to save fluid (e.g. steady state @ 65 MPH). It is currently not mentioned as an AECD. CHEATERS!**” FCA-MDL-000748062 (MDL Ex. 94) at 063 (emphasis supplied). Mr. Zatorski wrote “I am” and Mr. Frank responded, “I will just come to ur office at noon.” *Id.* Mr. Zatorski testified that lowering the dosing rate could lead to an increase in NOx emissions and that “during off-cycle” meant during conditions that wouldn’t occur during testing but would occur on the road. Zatorski. Tr. 120:13-21; 121:5-10. Designing emissions control functions to specifically reduce their effectiveness during off-cycle conditions render those features defeat devices (especially if they are not clearly disclosed to regulators).

234. On February 19, 2013, Mr. Jaffri gave a test plan to VM Motori for an evaluation in anticipation of brining the issues to Roger Orteca’s Certification Group at FCA. Jaffri Tr. at 114:17-23; FCA-MDL 001521474 (MDL Ex. 81), at 500. Mr. Jaffri asked VM Motori to run a test on Online Dosing to determine its effects on the emissions controls prior to him bringing the information to the Certification Group. *Id.* at 71:23-72:15; FCA-MDL 001521474 (MDL Ex. 81). **The test showed under “mid load” steady state conditions Online Dosing increased tailpipe out NOx by approximately 1 gram above Standard Dosing.** *Id.* at 76:23-79:5; FCA-MDL 001521474 (MDL Ex. 81), at 475. Under Online Dosing the dosing was approximately 40% lower than under Standard Dosing. *Id.* at 86:1-16; FCA-MDL 001521474 (MDL Ex. 81), at 485. Online Dosing caused a significant drop from the target ammonia load, which increased tailpipe NOx emissions. *Id.* at 86:17-89:20. Features that reduce the conversion efficiency of the SCR and/or increase tailpipe NOx emissions are AECDs and defeat devices (unless the manufacturer provides in its application for COC a justification for why it meets and exception).

235. Mr. Jaffri researched the regulatory definitions of “AECD” and “defeat device.” *Id.* at 93:18-95:13. Prior to reviewing the definitions, Mr. Jaffri had thought an AECD included only features that increased emissions, but then realized that an AECD is “anything that can affect emissions control, when you’re dealing with combustion engines, it’s pretty much everything on electronically fueled engines. The whole system ...all the elements of the system are, in facts, AECDs...” *Id.* at 95:17-96:4. Mr. Jaffri also reviewed the definition of “defeat device” because of the questions he had about Online Dosing. *Id.* at 98:10-21.

236. On February 26, 2013, John Needham of Bosch emailed Kasser Jaffri, stating “You will have the biggest impact from on-line dosing at the highest SCR temperatures (> 300) since the NH₃ load is lower and, therefore, less forgiving of on-line dosing. Also, the combination of adaptation followed by on-line dosing should also be documented.” FCA-MDL 001521474 (MDL Ex. 81), at 499. This means that when the ammonia loading on the SCR substrate is lower, Online Dosing will reduce NO_x conversion efficiency. Jaffri Tr. at 110:25-112:5. And Mr. Needham was also saying that the adaptation feature should be documented as an AECD to the EPA and CARB. *Id.* at 112:7-24. *See infra* at ¶¶ 284-317 for the discussion of adaptation.

237. On February 28, 2013 Giorgio Zacchi emailed the AECD write up for the disclosure of Online Dosing to Roger Orteca, Beth Borland and Gerald Kopinski, in the same format as other AECD were disclosed, stating, “Please review it and let me know if ok or more explanation needed. ... When you approve it, let me know, since I need to communicate Bosch the need for an additional AECD timer.” FCA-PIRNIK-001995149. The attached write up, in the same form as is done for AECDs disclosed to the EPA, specifically identifies Online Dosing or “alternative pre-control” dosing, admits that **“[a]n increase in NO_x emissions could exist,**

depending on the alternative pre-control DEF dosing calculation strategy” and under the heading “Substantially included in the FTP Test?” (which is an exception for defeat devices) states: **“No. Although this feature is active during the FTP, the activation conditions should not be reached.”** FCA-PIRNIK-001995151-152 (emphasis supplied); *see also* FCA-MDL 001521474 (MDL Ex. 81), at 498. This means that Online Dosing would not be activated during the FTP cycle because the FTP cycle does not reach the operating conditions that activate online dosing. Jaffri Tr. at 103:22-104:7. Mr. Zacchi then forwarded the AECD write up to Mr. Jaffri (copying others), “The Cert group already have it. I told them that it’s fine for you to put into the extended AECD document.” FCA-PIRNIK-001960759. Mr. Jaffri wrote back on March 14, (in advance of a meeting with Cheryl Stark on the issue), “Under the statement ‘justification’ we plan on stating that this mode is required for two (2) reasons. 1- Ammonia slip, 2- Ammonia oxidation. I’m clear on impact of ammonia slip. However, I not completely clear on the oxidation issue. Can you explain what the negative impact of ammonia oxidation as it relates to an need to justify this as an AECD.” *Id.* at 759-760. Mr. Zacchi responded, “We’ll put a ‘good answer’ about NH₃ oxidation...In the meanwhile I’m answering about your last question: Roger is waiting for you to give him a feedback about the alternative precontrol. **If you think it is ‘increasing emission’ situation for certain driving conditions, we have to put it into the AECD** and ask for the AECD timer to be implemented in the sw. My suggestion: when you’re going to discuss this topic together, you can invite Roger and agree once forever.” *Id.* at 759 (emphasis supplied). Notably, in internal presentations into 2014, as opposed to drafts of potential justifications to regulators, the purpose of Online Dosing was acknowledged as only “DEF consumption control” and “NH₃ slip prevention.” FCA-PIRNIK-001680758, at 2. Neither

DEF consumption control nor ammonia (NH₃) slip prevention are conditions that damage the engine. Thus, they are not exceptions to being a defeat device.

238. Furthermore, the threshold for transitioning into Online Dosing was at a “NO_x mass flow rate” of 45 mg/s. FCA-PIRNIK-001680758, at slide 4. This value is approximately one-fifth of the maximum NO_x mass flow rate that is expected from this engine. Indeed, for comparable heavy-duty diesel engines (that are certified over engine dynamometer cycles, and not chassis dynamometer cycles), a typical average NO_x emissions rate, without aftertreatment, may be in the 4-5 g/bhp.hr range, where here NO_x emissions per unit mechanical work output (bhp.hr) are considered. Using this value, the NO_x emissions rate of 45 mg/s implies that Online Dosing would be invoked at an engine output of 36 bhp (brake horse power) which is (as the figure in FCA-PIRNIK-001680758, at slide 4 implies), at a relatively low power output for such an engine (which is said by FCA to have a maximum power output of 240 brake horsepower). Therefore, the Online Dosing strategy would be active for much of the engine operation and hence should have been disclosed as an AECD. In fact FCA-PIRNIK-001488018 at slide 4 (dated August 11, 2014) shows that the 45 mg/s engine-out NO_x emissions flow rate is exceeded multiple times and for extended periods of time in the cycle considered, especially as in the data presented, the EGR valve is closed for an extended period, thus leading to the elevated [tailpipe?] NO_x emissions levels. In the same document (page 3) there is a “Proposal for locking standard dosing in SCP” that explains:

“Current upper-threshold for NO_x engine out is 45 mg/s. In order to lock the system in standard dosing, the upper threshold might need to be increased to 85-90 mg/s.

- Impact on emission cycles (US06) and DEF refill interval can be significant”.

FCA-PIRNIK-001488018, at 020. This quotation places an entirely artificial upper limit on the expected engine-out NOx emissions of the engine that “lock[s] the system in standard dosing”. This shows that there were two distinct modes of SCR dosing in the engine and/or ATS control, which were not disclosed as AECDs. Furthermore, there is an acknowledgement that swapping between the two strategies has a potentially “significant” impact on DEF refill interval, and hence presumably DEF consumption rates. The apparent manipulation of DEF consumption rates (without regard for NOx conversion in the SCR) seems to ignore the basic requirement for the DEF consumption which is the conversion of the requisite amount of engine-out NOx emissions to permissible tailpipe-out NOx levels. The actual DEF consumption rate realized during vehicle operation would arise from the fulfillment of this regulatory requirement, and should not be a driver of an emissions control strategy (issues of potential SCR catalyst damage, and ammonia slip notwithstanding).

239. After Mr. Jaffri observed increased emissions and decreased NOx conversion efficiency from Online Dosing, he raised his concerns about the disclosure of Online Dosing and its status as a possible defeat device with Cheryl Stark at FCA on or about March 14, 2013. FCA-MDL-000431528 (MDL Ex. 82). He emailed Ms. Stark the definition of AECD and defeat device. FCA-MDL-000377747 (MDL Ex. 83); FCA-MDL-000377749 (MDL Ex. 84). Discussing the exceptions for a defeat device, Mr. Jaffri stated:

“Other than these three criteria, everything else is clearly considered a defeat device by EPA’s definition (see attached). **I cannot find any mention allowing operation an AECD to avoid negative emissions (NH3) or to avoid any other negative engine performance impacts. Therefore, based on the list above, on-line dosing can only fall under item two (2) if it is to be considered a AECD, otherwise it is a defeat device which is prohibited from use.** ... As you suggested, I asked VM to explain ammonia oxidation as a means for justification...everything I found thus far indicates this effect is nothing more than converting NH3 to nitrogen (n2) and water (H2O) with the most common application with SCR system is for NH3 slip catalyst. **I have not found**

anything to support the argument that this increases the deterioration of SCR catalyst performance over its full use-full life.”

MDL Ex. 83 at 747 (emphasis supplied).⁷ Thus, NH₃ (ammonia) slip is not something that damages the engine, and it is not a valid reason for the implementation of a defeat device.

240. Mr. Jaffri and Mr. Zatorski took the information about Online Dosing to FCA’s Certification Group (Roger Orteca and Jerry Kapinski) so they were aware of the feature and that from their perspective it should be disclosed as an AECD. *Id.* 70:12-71:12.

241. On March 20, 2013, Mr. Jaffri had a meeting with Roger Orteca, Giorgio Zacchi, Ethan Stiles, Michele Padovan, Riccardo Pettazzoni, Emanuele Palma and Hal Zatorski, the purpose of which was for Mr. Jaffri and Mr. Zatorski to raise their test results and findings about Online Dosing to Mr. Orteca’s attention as the head of FCA’s Certification Group. Jaffri Tr. at 134:9-135:4. Following the meeting, Mr. Jaffri sent an email to the participants (copying Ms. Stark and Mr. Berry) summarizing the discussion at the meeting, stating, in part,

“This mode will only be used to prevent ammonia slip emissions. Work will continue by VM to insure the best possible SCR conversion efficiency is achievable under all reasonable driving conditions while preventing ammonia slip under dynamic load cases ... **If alternative pre-control is applied, Chrysler will request an AECD for alternative pre-control dosing mode from EPA** to safeguard against possible ammonia slip emissions since ammonia gas is a known irritant...Since **the AECD requested will be justified as safety concern, and not for engine component protection**, an associated EI-AECD timer will not be required for the OBD system.”

⁷ Online Dosing also inhibits the SCR conversion efficiency diagnostic. Jaffri Tr. at 146:5-7. Under standard dosing, the diagnostic runs and checks the NO_x conversion efficiency of the SCR system, and if the diagnostic detects that the conversion efficiency drops below a certain level it would cause a fault and the “check engine light” would illuminate indicating that the conversion efficiency was deficient. *Id.* at 146:5-147:10. However, under Online Dosing, the NO_x conversion efficiency diagnostic does not run at all. *Id.* at 147:11-17. Therefore, there is absolutely no way that the OBD system can check the conversion efficiency in the SCR while Online Dosing is occurring. *Id.*

FCA-MDL-000478134 (MDL Ex. 85) (emphasis supplied). Thus, FCA determined that the justification for Online Dosing that they would provide to the regulators (if they used it and disclosed it) would be only ammonia slip, not ammonia oxidation. However, there is no exception to the definition of a defeat device for protecting people from an irritant such as ammonia. The exception only applies for AECDs that are necessary for “protecting the vehicle against damage or accident.” Neither of the other exceptions apply, as recognized by Mr. Jaffri because activation conditions for Online Dosing were not expected to be reached on the FTP test, and Online Dosing was not only used for engine starting. Therefore, Online Dosing, which the draft disclosure document admitted increased NOx emissions is not only an AECD that required disclosure, but also a defeat device.

242. Shortly after this meeting, FCA decided (at least briefly) to not use Online Dosing. FCA-MDL-000478134 (MDL Ex. 85). Mr. Jaffri’s March 20, 2013 email was forwarded to Mark O’Donovan by Mr. Zacchi, stating,

“Last Wednesday we met with Roger, Hal and their team. We discussed about the alternative precontrol dosing strategy. According to their analysis, the alternative precontrol is borderline for the OBD requirements; furthermore **the urea slip can be avoided also with the std dosing strategy**. Based on the inputs coming from that meeting, the std urea dosing strategy will be extended to cover the whole SCR functionality. We’ll work to refine the dosing strategy and re-assess the urea consumption.”

Id (emphasis supplied). Mr. Orteca informed Mr. Jaffri that Online Dosing would not be used on the Subject Vehicles. Jaffri FCA-MDL-001449549 (MDL Ex. 92); Tr. at 143:6-16; *see also* FCA-PIRNIK-001471726 (March 20, 2013 email from Giorgio Zacchi to Kasser Jaffri: “Based on the discussion we had yesterday we are moving forward with no alternative precontrol in the SCR dosing strategy. This is the document that EMI Cert Group already submitted to EPA. No alternative precontrol in here.”). As the above confirms, Online Dosing was not necessary to

prevent ammonia slip, which was the purported justification that FCA was going to provide to its regulators (if it disclosed it). After the March 20, 2013 meeting, Mr. Jaffri instructed Bosch to remove references to Online Dosing from the Subject Vehicles' certification documents. *Id.* at 154:9-25.

243. FCA shortly thereafter changed course and decided to use Online Dosing in the Subject Vehicles (despite it not being necessary to avoid ammonia slip) but never specifically disclosed it to the EPA or CARB. Jaffri Tr. at 143:17-145:4. FCA never provided to its regulators the write up prepared earlier regarding Online Dosing *Id.* at 104:8-16. Rather than disclosing the existence of two separate dosing modes, FCA provided a "map" that showed the net result of the Subject Vehicles' entire dosing strategy on NOx conversion efficiency. This was inconsistent with how Mr. Jaffri thought it should have been disclosed. Jaffri Tr. at 145:1-4 ("You know, you're showing the net results, so the information is there. But it's not at the detail like what OBD would do.").

244. On June 11, 2013, Michele Padovan emailed Messrs. Pasini, Palma, Pettazzoni, Forlani and Lipkowitz, attaching the then current AECD list for the Subject Vehicles. FCA-MDL-000295192 (MDL Ex. 86); FCA-MDL-000295194 (MDL Ex. 87). Mr. Padovan wrote, "**we are not mentioning online dosing at all** ... We don't mention anything about the on line dosing since we are showing an efficiency map with efficiencies already in on line dosing, so we were told we were covered." MDL Ex. 86 at 192 (emphasis supplied). Mr. Jaffri confirmed that the efficiency maps do not explicitly identify Online Dosing (Jaffri Tr. at 167:3-168:1), there is no justification provided for Online Dosing as required by the regulations (Jaffri Tr. at 168:2-6), or anything that identifies the parameters that are used to activate Online Dosing. Jaffri Tr. at 168:8-13. It was Mr. Orteca's group that was responsible for approving the AECD list. Jaffri Tr.

at 163:1-15. At his deposition, Mr. Jaffri admitted that the efficiency maps were not sufficient disclosure of the AECD Online Dosing. Jaffri Tr. at 161:6-162:24.

245. On July 23, 2013, in response to a question about the purpose of Online Dosing, Mr. Padovan admitted internally that the true purpose was to reduce dosing in off-cycle conditions so FCA could conserve DEF:

“In a nutshell there are two strategies for injecting urea into the SCR: standard dosing and on-line dosing.

The standard dosing is what you do in cycle to obtain the maximum efficiency of NOx conversion.

The on-line dosing is theoretically used under certain conditions (ex: very high SCR temperatures) where you know the discharge is not as efficient as it should be. So if one were to inject according to standard dosing under these conditions, urea would not convert the NOx but would escape from SCR (urea slip). **In reality, we use the online dosing as soon as we can outside of the cycle to consume less urea. Obviously if you close the EGR and make more NOX and you are in online dosing, there is no chance that the additional NOx you are producing is being swallowed by the SCR**”

FCA-PIRNIK-001653778 (translation) (emphasis supplied); Palma Tr. at 204:23-206:8. This supports my conclusion that Online Dosing on the Subject Vehicles is an AECD and a defeat device. As discussed herein, Online Dosing is a defeat device for three reasons; (i) purposefully causing the emissions control to perform differently during the emissions tests (during the “cycle”) is an impermissible defeat device, (ii) using Online Dosing solely for purposes of reducing DEF consumption without regard for the actual tailpipe-out NOx emissions during real-world operation is a defeat device, and (iii) an AECD that increases NOx emissions is a defeat device (no allowable exceptions apply in this case).

246. In an email exchange between Sergio Pasini, Riccardo Pettazoni and Emanuele Palma on July 28, 2013, they admitted that conversion efficiencies decline under Online Dosing and that the AECD disclosures to regulators are not transparent about Online Dosing. Mr.

Pettazzoni wrote “**I am convinced everyone knows [Online Dosing] is not transparent in terms of what is written in AECD...** Given the increase in NOX it’s true that the SCR system reacts because, as a trend, it will dose more in proportion from the NOX sensor, **but this does not guarantee the same efficiency.**” FCA-PIRNIK-001698891 (translation) (emphasis supplied).

247. On September 12, 2013, Mr. Jaffri raised his concerns again to Daniel Hennessy and Larry Nowak, stating “**On-line dosing reduces the conversion efficiency effectiveness and therefor monitoring cannot be run during these times. This dosing strategy is not officially declared through AECD to EPA nor CARB** with EI-AECD although still active. **This continues to be an area of concern.**” FCA-MDL-000714943 (MDL EX. 88), at 944 (emphasis supplied).

248. On January 22, 2014, in response to questions regarding disclosure of Online Dosing in the RAM Promaster 2015 MY (not one of the Subject Vehicles, but a FCA vehicle with the same engine and engine control system, by accounts), Mr. Jaffri told Tamas Szailer, “**I suggest not to mention on-line dosing specifically in the AECD doc**, but simply disclose the ‘slip optimized’ SCR conversion efficiency map based on speed and load. ... Again, no need to mention the alternative mode, just document the system performance. **Best to disclose in this form in case CARB compliance testing shows higher than expected emissions during real-world conditions (steady state cruising at 70 mph at 50% payload rating).**” FCA-PIRNIK-001402710 (Jaffri Ex. 2), at 712 (emphasis supplied).

249. In a message exchanged between Tamas Szailer and Kasser Jaffri on or about April 8, 2014, they questioned FCA’s practice of non-disclosure of AECDs and defeat devices. FCA-MDL-00037760 (MDL Ex. 99), at 764. Discussing the disclosures for the RAM Promaster,

Mr. Jaffri wrote “all of the EI-AECD Timers now should match the AECD doc, for the WK/DS. *Id.* Mr. Szailer wrote “only DEF frozen/cavity **all the rest are ‘claimed’ to be not impacting emissions**” and Mr. Jaffri wrote, “By definition, an AECD reduces the effectiveness of the emission control system under conditions that are NOT encountered in the emission test cycles and occur in conditions other than engine starting. So by definition, an AECD does impact emissions.” *Id.* (emphasis supplied). After sending Mr. Szailer the regulation, Mr. Jaffri stated

“I think VM and Fiat try to leverage the first paragraph and state that the AECD which ‘deactivates the operation of part of the emission control system’, does not impact the emission control system which is crap. ... **If I worked for EPA, I would jump all over this. .. I know that the AECD documents are crap** ... I brought this up some time back and I got push back I was told, this is emissions, not OBD, back off. Lol. **Emissions guys are cheaters, and they know it.**”

Id. at 764 (emphasis supplied).

250. In an internal presentation entitled “WK/DS MY15 DEF Dosing Strategy” dated 22 September 2014, the statement “Online dosing strategy” provided the following: “When specific conditions are met (environmental and exhaust temperature, barometric pressure,...), the calibration switches to an alternative dosing strategy in order to contain DEF consumption”. FCA-PIRNIK-001653437, at slide/page 7. While control system behavior such as this is not explicitly proscribed by regulation, such a “calibration switch” is clearly an AECD and must be disclosed to regulators. (This use of alternative calibration maps or control strategies has a distinct parallel in that of the Volkswagen Group, in which variables or parameters that are or were known to hew to a very close range during regulatory testing (such as steering angle, ambient temperature, or ambient or barometric pressure) were used to determine when the vehicles were likely to be being tested, or being driven under real-world driving conditions). Under “Summary”, “Target lower NOx conversion efficiency when in “online dosing”. This calibration can have significant impact on DEF consumption without affecting cert. emissions

and limited impact on OBD (SCR monitor disabled in “online dosing”) but it requires further discussions and agreement with the agencies”. *Id.* at slide/page 9. The idea that “SCR monitor” is disabled in “online dosing” mode is a further troubling aspect as far as emissions and OBD regulatory compliance is concerned.

251. On the same date (September 22, 2014) in an email from Rocco Vicedomini to Palma and others, he stated

“For online dosing there are ample room to reduce the dosing on WK NAFTA as well (approach proposed as a first step but **revised to avoid declaring this function on the AECD)** **We need to find an agreement between us, Chrysler and Bosch, to support a sustainable strategy towards CARB (component protection against high dosing rate may suffice?)**”

FCA-PIRNIK-001653018_T001 at T004 (translation) (emphasis supplied). The statement “revised to avoid declaring this function in AECD” is a clear admission of a lack of candor in disclosure to the regulatory agencies, as is the concept of needing to find “agreement between us, Chrysler and Bosch to support a sustainable strategy against CARB”.

252. On October 15, 2014, Mr. Jaffri told Tamas Szailer, when discussing the RAM Promaster, to not disclose Online Dosing to CARB because the regulators did not know about it: **“He doesn’t know about on-line dosing, so don’t bring it up that’s going to get real ugly if you do”**. FCA-MDL-000377754 (MDL Ex. 89) (emphasis supplied). Mr. Szailer responded, “Ok, we do not have that in the aecd.” Mr. Jaffri stated, “I know – **Its in the OBD docs to protect us from emissions cheating in case its discovered**, its disclosed in the OBD material at least so its not going to bite me!” *Id.* (emphasis supplied). When Mr. Szailer asked why it was never disclosed, Mr. Jaffri stated, “I think **the past strategy is to push it through at the end since they have rubber stamped it b4**. That’s not working any longer.” *Id.* (emphasis supplied).

See also FCA-MDL-000219342 (MDL Ex. 95) (“CARB OBD is smart enough to catch what CARB Emissions is not.”).

253. On October 27, 2014, again discussing the RAM Promaster, Mr. Jaffri wrote to Mr. Szailer that FCA was not adequately dosing in situations in which engine out NOx was high, such as when the EGR was turned off, and Mr. Szailer admitted that Online Dosing was used to hit DEF consumption targets, not to limit ammonia slip: “FYI: CARB will ask that you do as much as possible to limit NOx emission in all driving conditions, so if you turn off EGR for component protection, then they will want you to dose as much as you can to limit NOx emissions.” FCA-MDL-000741125 (MDL Ex. 90) at 126. Mr. Szailer responded, “I wish Fiat would know this.” Mr. Jaffri responded, “Also, I hope that you guys are using on-line dosing to really just limit slip, and not for urea consumption targets.” Mr. Szailer responded, “**hahaha you know that it is used for def consumption.**” Mr. Jaffri wrote “**if they find out its over.**” *Id* (emphasis supplied). In his deposition, Mr. Szailer elaborated that “by definition, online dosing reduces the amount of urea which is being dosed if you switch from storage mode to online mode.... And obviously that's why online dosing has a secondary benefit. It's also used for DEF consumption, reducing DEF consumption.” Szailer Deposition, 96:15-20.

254. In late 2015, following the VW scandal, Mr Jaffri again told FCA’s emissions Certification Group run by Roger Orteca as well as Dave Smolarek and Beth Borland that Online Dosing should be explicitly disclosed. Jaffri Tr. at 187:23-190:9. On September 22, 2015, discussing MY18 vehicles, Mr. Jaffri wrote in an email that went to, among other, Dan Hennessy, Roger Orteca, Hal Zatorski, Emanuele Palma, Dave Smolarek, Michele Padovan and Thomas Larose, “**If alternative precontrol, or on-line dosing is used for MY18, then it must be disclosed as an AECD.**” FCA-MDL-000083014 (MDL Ex. 91) at 016 (emphasis supplied).

He also wrote that FCA should “Update the AECD to clearly identify that two (2) DEF dosing modes are being used, normal and on-line dosing (aka alternative pre-control), as we agreed to back on 3/20/2013...Explain what on-line dosing is... Justify the use of on-line dosing is necessary to prevent NH3 slip (health safety) and is **not used to limit the dosing rate for DEF consumption targets**. ... [and] Show the online dosing conditions in the AECD doc as disclosed in the OBD documentation (see table below).” *Id.* at 014 (emphasis in original). *See also* FCA-MDL-001449549 (MDL Ex. 92).

255. In a message between Mark Frank and Hal Zatorski on or about September 29, 2015, Mr. Frank wrote “Chrysler diesels do “on-line” dosing. B sure 2 tell Shost he can thank Kass (& me) for minimizing it’s off-cycle effects & making sure it was documented in the cert docs. Or FCA would have been in the same boat w VW.” Mr. Zatorski asked “what do you mean by ‘on-line’ dosing?” Mr. Frank responded that “It’s a Bosch term ... **A way to reduce dosing when not on FTP**.” Mr. Zatorski wrote, “**how to reduce it without blowing emissions???**” and Mr. Frank responded, “**You can’t ... They go hand in hand**.” FCA-MDL-000416569 (MDL Ex. 100) (emphasis supplied).

256. After the EPA and CARB began investigating FCA for defeat devices and failure to disclose AECDs in late 2015, Mr. Jaffri and Mr. Zatorski discussed that FCA’s regulators would be concerned about the legality of Online Dosing and that it was used to hit DEF consumption targets. On June 17, 2016, Mr. Jaffri wrote to Hal Zatorski, “ARB is going to flip out over this on-line dosing stuff.” FCA-MDL-000377586 (MDL Ex. 93). Mr. Jaffri was referring to all the storage model target maps that had never been shown to the regulators before. Jaffri Tr. at 220:12-223:2. Mr. Zatorski replied, “dosing boo boo, eh?” and Mr. Jaffri responded, “yup, fugly ... **they really messed up by not including that in the MY14-16 AECD**.” Mr.

Zatorski wrote back, “**essentially a defeat device**” and Mr. Jaffri wrote “**I told them**”. FCA-MDL-000377586 (MDL Ex. 93) (emphasis supplied). Mr. Jaffri testified that he was talking about Roger Orteca’s Certification Group at FCA. Jaffri Tr. at 225:22-226:1.

257. Indeed, as soon as the EPA began its investigation into the Subject Vehicles, it identified the failings caused by the interaction of Online Dosing along with reduced EGR. *See infra*, at ¶¶ 346-387; FCA-PIRNIK-001477978. In a December 14, 2015 FCA email from Mr. Palma to Mr. Shost and Mr. Hennessy entitled “RE: 14MY 3.0L RAM Follow-up Discussion” he wrote “We had our follow up meeting at EPA today, ARB also called in. They collected more material both on the rolls and on the road and they summarized their concerns in 5 main items”. Under the third item, he wrote “Original 2014 calibration (before SCR replacement) ramps EGR to zero at higher vehicle speeds and dosing is not adequate to control NOx tailpipe emissions”. Clearly the combination, in this case, of reduced EGR and Online Dosing was not sufficient to remediate NOx levels to regulated emissions levels as expected by EPA, and CARB. FCA-PIRNIK-001477978.

2. **Online Dosing Is An AECD That FCA Failed To Disclose and Is A Cycle Detecting Defeat Device**

258. As discussed above, Online Dosing is an AECD because it is a feature which senses a parameter (i.e. at least “environmental temperature” as cited in FCA-PIRNIK-001653437 at 7) for the purposes of “activating, modulating, delaying, or deactivating” the “operation of [] part of the emission control system”, namely the injection of DEF or urea.

259. Online Dosing affected NOx emissions from the Subject Vehicles. As such it was required to be disclosed to EPA and CARB. The interruption or cessation of DEF dosing to the ATS, all else remaining equal, would most definitely have a deleterious effect on the NOx

348. On September 21, 2015, FCA US's Senior Vice President for Communications, Gualberto Ranieri, was contacted by Reuters, which was "trying to establish the impact of the VW saga on other carmakers", and asked

1. Has Fiat Chrysler been contacted by the EPA or other U.S. authorities over any violations regarding rules on emissions control?
2. EPA and California Air Resources Board told us that they have begun procuring diesel vehicles for testing from other companies beyond Volkswagen. Also from Fiat Chrysler? If so, which model?
3. Has the EPA already tested any of your diesel-powered models and if so, what were the conclusions?
4. Has Fiat Chrysler been using any defeat devices similar to those installed by VW?

FCA-PIRNIK-001622711, at 712. The request was forwarded to Bob Lee, Scott Kunsleman, Mark Chernoby, Eric Mayne (FCA's Manager of Media Relations), Dan Reid and Bergi Alexanian. Bob Lee informed Mr. Ranieri that they "We are all in the Product Committee at the moment" (the Product Committee was a monthly meeting with senior management, including Sergio Marchionne; B. Lee Tr. at 204:3-5). Mr. Mayne suggested stating in response to the inquiry "FCA US LLC works closely and continually with the EPA and CARB to ensure its vehicle are compliant with all applicable emissions requirements. FCA US vehicles function the same on the road as they do under testing." *Id.* at 711. Bob Lee told Mr. Mayne to "only use your first sentence" and not state that "FCA US vehicles function the same on the road as they do under testing" because Mr. Lee thought the second sentence could mislead the reader. B. Lee Tr. at 198:14-16.

349. The next day, September 22, 2015, Reuters published an article citing FCA US as stating "FCA U.S. does not use 'defeat devices'" and that it was working closely with the EPA and CARB to "ensure its vehicles are compliant with all applicable requirements." Mr.

Marchionne forwarded an Italian version of the article to Mr. Ranieri, asking “What the hell is this?” FCA-PIRNIK-001624122, at 123 (translation). Mr. Ranieri responded:

“We got the ok by Bob Lee to say:

Yesterdays: FCA US LLC works closely and continually with the EPA and CARB to ensure its vehicles are compliant with all applicable requirements.

And today: FCA US does not use ‘defeat devices.’”

*Id.*⁹ Mr. Marchionne chastised Mr. Ranieri for telling the public that FCA US does not use defeat devices, stating “Are you out of your goddam mind?” *Id.* Mr. Ranieri told Mr. Marchionne that the statement was approved by senior management, including Mark Chernoby and Scott Kunselman. *Id.* at 122. Mr. Marchionne stated, “You should be fired for such stupidity” and “Utterly stupid and unconscionable.” *Id.* Mr. Marchionne made clear that he was taking a personal responsibility for the issue of defeat devices on vehicles sold in the US. “Send everything to Margie and issue nothing else without my approval.” *Id.*

350. On September 30, 2015, Morrie Lee emailed Joel Dalton of the EPA concerning FCA’s understanding AECD disclosure under the regulations, stating:

Even before VW, we were working on the subject topic to be disseminated to all calibrators, etc. An excerpt from our flow chart (which is the entry point) and essentially and quote from the regs, is the following:

Does the feature sense any parameter (including timer based deactivations) with the result of 1) activating, deactivating, modulating, or delaying the operation of any part of the emission control system (exhaust or evap) or 2) impacting the fuel economy of the vehicle in any way?

In our flow chart, answering yes to this question indicates that the feature is an AECD. The driveability and emissions upper management think that the definition is too broad. Is there a more up to date guidance on AECD’s and defeat devices.

⁹ Mr. Lee testified that he did not recall whether he had a conversation with Mr. Ranieri giving permission to say that FCA US does not use defeat devices. B. Lee Tr. at 202:13-25.

certified that all AECDs had been disclosed, Mr. Mazure never reviewed the applications. *Id.* at 58:14-21; 60:2-4. When submitting applications that purported to list all AECDs, despite signing the applications, Mr. Mazure testified that he did not know if the information was accurate. *Id.* at 70:25-72:10.

412. Mark Shost acknowledged that this “siloeing” of information concerning AECDs and defeat devices was done specifically to keep Regulatory in the dark since it was Regulatory (not the Certification Group) that actually interacted with and made representations to the EPA and CARB. As Mr. Shost stated:

“• The cert group must be in a different org than powertrain is wrong. In NAFTA the cert group is under a different Director but part of powertrain. **The benefit of not being in regulatory is the cert group works with the calibration and controls team when discussing what is acceptable especially if nuanced, as acceptable.** After they conclude cert takes to regulatory for approval. **These discussions probably can't occur with regulatory since regulatory should never be placed in a compromised position as they have to represent the company to the agencies.** I won't list examples here but I'll say these issues come up every month and you need a means for decision/direction. I also don't think the separate director is important it was just a function of scale in NAFTA, in fact Roger Orteca used to attend all my staff meetings so he understood calibration issues, ...

• **The key understanding is regulatory is separate from powertrain and they have responsibilities to agencies while cert group is part of powertrain.**”

FCA-PIRNIK-001646367.

413. This structure is inadequate and ineffective for ensuring compliance and transparency to regulators. Moreover, it is improper to have the persons responsible for determining what calibrations features are AECDs or defeat devices and what should be disclosed not be independent of Powertrain. It creates a conflict of interest between the purpose of Powertrain, performance of the engine, and compliance with the emissions regulations. Indeed, the very conflict of interest was the reason that FCA stated that it reorganized its

organization in August 2014 to make its Regulatory Affairs group independent of engineering. FCA publicly announced that it specifically created the regulatory position held by Mr. Dahl in August 2014 (at that time it was held by Scott Kunselman) to “ensur[e] a high level of information flow and accountability” as to regulatory compliance. 2014 Annual Statement filed March 9, 2015. The above structure and practices concerning emissions compliance are antithetical to accountability and transparency.

414. Moreover, despite FCA specifically creating Mr. Dahl’s position the year before to ensure accountability and transparency as to regulatory compliance, Mr. Dahl testified that he never had any communications with Mr. Marchionne regarding (as discussed above) the EPA’s investigation, their repeated statements that they believed FCA’s vehicles contained defeat devices, and that “[a]ll efforts are to prove no defeat device” (e.g., FCA-PIRNIK-002074700). Dahl Tr. at 95:25-96:3; 108:9-11. Mr. Dahl testified that he never met with Mr. Marchionne to specifically discuss FCA’s compliance status with the EPA until June 29, 2016 meeting (a month after the May 27, 2016 EPA letter). Dahl Tr. at 110:20-111:12. Other than monthly product committee and industrial committee meetings that involved as many as 30 individuals and did not discuss compliance at all, Mr. Dahl never communicated with Mr. Marchionne, other than forwarding the minutes of the VRSC after that meeting occurred. *Id.* at 11:13-113:5; 118:5-119:19; 120:7-122:18. Mr. Dahl testified that he was never consulted regarding any of Mr. Marchionne’s of FCA’s statements concerning compliance, defeat devices, or emissions regulations despite Mr. Dahl being purporting to be the person most knowledgeable on the subjects. *Id.* at 173:14-23.